REMARKS

Claims 1-9, 11-27, 29, 30, and 32-39 are pending. Claims 1, 4, 7, 9, 11, 13-15, 18, 22, 25-27, 32, 33, and 37 have been amended. Applicant reserves the right to pursue the original and other claims in this and any other application.

The specification has been amended to correct minor typographical errors. No new matter has been added.

Claim 9 stands objected to under 37 C.F.R. § 1.75(b) as being identical to claim 3. Claim 9 has been amended and Applicant respectfully submits that it is now patentably distinct from claim 3. Therefore, applicant respectfully requests that the objection to claim 9 be withdrawn.

Claim 15 stands objected to due a minor grammatical error. Claim 15 has been amended to correct the error. Therefore, applicant respectfully requests that the objection to claim 15 be withdrawn.

Claims 26, 32, and 33 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. The claims have been amended in view of the Examiner's remarks. Applicant respectfully submits that claims 26, 32, and 33 are now in compliance with 35 U.S.C. § 112, second paragraph. Therefore, applicant respectfully requests that the rejection of claims 26, 32, and 33 be withdrawn.

Claims 1-9, 11-27, 29, 30, and 32-39 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lynn (U.S. Patent No. 4,928,307) ("Lynn") in view of Walker et al. (U.S. Patent No. 4,809,274) ("Walker"). The rejection is respectfully traversed.

Claim 1 recites a gain determining stage for determining a gain signal to be applied to amplify a digital audio signal. The gain determining stage comprises "an input for receiving a parameter of said digital audio signal; an adjuster for adjusting said parameter dependent on a received volume control signal; and a gain selector for applying a variable gain function to said volume control signal in order to generate a gain signal for applying to the digital audio signal, wherein said gain function is dependent on said adjusted parameter."

The present invention is directed to the problem of applying a variable gain to an input signal while also ensuring that the input signal, with the gain applied, does not exceed a threshold. Conventionally, this is achieved through two stages – a first stage in which the variable gain is applied to the input signal and a second stage, usually comprising a peak detector, to determine if the amplified input signal exceeds a predetermined threshold. This prior art, two-stage, solution requires complex hardware when implemented in the digital domain: a first multiplier to apply the variable gain signal, a second multiplier to apply the peak-limiting gain signal, and a wide data bus to accommodate the large digital word length necessary to represent the high peaks in the amplified input signal prior to peak limiting.

The present invention provides a gain determining stage that provides a more hardware-efficient solution to this problem. The following explanation makes references to elements of Applicant's FIG. 2 in order to illustrate features of the claim and distinctions over Lynn. The particular configuration of FIG. 2 is merely illustrative of a disclosed embodiment, however, and should not be not interpreted as limiting the scope of the claims.

Referring to the elements of claim 1, an input (e.g., signal *Vin*) provides a parameter of a digital audio signal. An adjuster (e.g., adder 208) adjusts the input signal parameter based on a volume control signal (e.g., signal *lgGs*). A gain selector (e.g., gain selector 209) applies a variable gain function to generate a variable gain signal (e.g., signal *lgK* or, following a log transform, signal *K*) based on the volume control signal and the adjusted input signal. As recited

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in dependent claim 13, for example, an amplifier (e.g., multiplier 204) amplifies the input signal based on the variable gain signal to generate an output signal (e.g., signal *Vout*). In other words, claim 1 recites a open-loop gain determining stage that evaluates at least two inputs – a parameter of a digital audio signal (e.g., *Vin*) and a volume control signal (e.g., *lgGs*) – to determine a variable gain (e.g., *K*) to be applied by an amplifier to generate an output signal.

Lynn, by contrast and with reference to FIG. 2, discloses a closed-loop feedback system in which the output 20 of an amplifier 18 is compared to a threshold. If the output exceeds a predetermined threshold for a sufficient period of time (e.g., 80 ms), a control voltage 32 is reduced by about 10 dB. (Col. 4, Lines 25-45) This has the effect of limiting the output 20 to a "safe and comfortable" listening level. Lynn does not teach or suggest selecting a gain based upon an input and a volume control signal, as recited in claim 1. Rather, Lynn simply monitors an output level 20 and reduces a control voltage 32 applied to a pre-amplifier 14 if the output level 20 exceeds a predetermined threshold for a long enough period of time.

Turning to the details of the rejection provided in the Office Action and again with reference to FIG. 2 of Lynn, the Examiner equates the claimed "adjuster" to the pre-amplifier 14 (a.k.a., the "variable gain amplifier") and the "volume control signal" to the control voltage 12, which controls the pre-amplifier 14. (Page 4, Lines 3-5) Later on the same line, the Examiner also equates the claimed "gain selector" to the pre-amplifier 14. In other words, the Examiner equates Lynn's pre-amplifier 14 to both the claimed "adjuster" and the claimed "gain selector". Applicant respectfully submits that equating the pre-amplifier 14 to the "gain selector" recited in claim 1 is improper. The pre-amplifier 14 does not "select" anything. According to Lynn, it is merely a conventional floating differential pre-amplifier. (Col. 4, Lines 6-7) As such, the pre-amplifier 14 adjusts an input 12 based on a control voltage 32. This is not a "selection" in any reasonable sense of the word.

Moreover, the pre-amplifier 14 of Lynn does not "apply[] a variable gain function to said volume control signal," as claimed by Applicant. Rather the pre-amplifier 14 of Lynn applies a gain (i.e., the control voltage 32) to the input 12. According to Lynn, the input 12 is "representative of the signal received by the headset over the telephone line...." (Col. 4, Lines 5-6) A signal output to a telephone headset, implicitly for conversion to sound waves to be heard by the telephone user, is not a volume control signal. Thus, Lynn fails to teach or suggest the claimed "volume control signal" and use thereof.

Furthermore, the pre-amplifier 14 of Lynn does not "generate a gain signal for applying to the digital audio signal," as recited in claim 1. (Although Lynn operates in the analog domain, the input 12 of Lynn is treated as equivalent to a digital audio signal for purposes of this discussion only.) Rather, the pre-amplifier 14 manipulates the input signal 12 itself by amplifying it based on the control voltage 32. Manipulating a first signal directly, as in Lynn, is not the same as generating a second signal to be applied to the first signal, as claimed. Thus, Lynn fails to teach or suggest a "gain selector for applying a variable gain function to said volume control signal in order to generate a gain signal for applying to the digital audio signal," as claimed.

As noted above, Lynn operates in the analog domain, and the Examiner correctly concludes that Lynn does not teach or suggest using a "digital audio signal," as claimed. Therefore, the Examiner relies on Lynn in combination with Walker and asserts that "it would have been obvious for one of ordinary skill in the art to [use a digital audio signal] with the motivation of conserving transmission bandwidth as taught by Walker." (Office Action, Page 4) Applicant does not dispute that Walker discloses a system for manipulating digital audio signals but respectfully notes that Lynn fails to teach or suggest many other limitations of the claimed invention, as described above. Walker does not cure the failings of Lynn.

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For at least all of the above reasons, applicant submits that the rejection of claim 1 over the Lynn and Walker combination should be withdrawn.

Claims 2-9, 11-24, 29, 30, and 32-36 depend from claim 1 and are allowable over the Lynn and Walker combination for at least the reasons stated above with respect to claim 1 and on their own merits. Therefore, the rejection of claims 2-9, 11-24, 29, 30, and 32-36 should be withdrawn and the claims allowed.
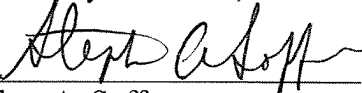
Claim 37 recites similar limitations as claim 1 and is allowable over the Lynn and Walker combination for the at least the reasons stated above with respect to claim 1 and on its own merits. Therefore, the rejection of claim 37 should be with drawn and the claim allowed.

Claims 25-27, 38, and 39 depend from claim 37 and are allowable over the Lynn and Walker combination for at least the reasons stated above with respect to claim 1 and on their own merits. Therefore, the rejection of claims 25-27, 38, and 39 should be withdrawn and the claims allowed.

In view of the above, Applicant believes the pending application is in condition for allowance and respectfully requests that it be passed to issue.

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Respectfully submitted,

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